



## **Combining of Radar and laser altimetry, MODIS Remote Sensing and GPS for the monitoring of flood events: application to the flood plain of the Diamantina river.**

J-F Crétaux(1),(2), M. Leblanc(2), S. Tweed(2), **S. Calmant**(1) and G. Ramillien(1)

(1) Legos/CNES, Toulouse, France. (2) Monash University, Melbourne, Australia

A method of wetland mapping and flood event monitoring was developed on the basis of a satellite multi-sensor data combination. The method has been developed and tested on the Diamantina River, which is located in Central Australia and is the main tributary of the Lake Eyre. This river basin, located in a very arid zone, is affected every three-four years by flood due to extreme precipitation in the North East of Queensland. The last time that such heavy rain occurred was in the beginning of 2004. The flood crossed the Diamantina river basin from upstream to the lake Eyre hundreds of kilometres downstream in a period of less than two months. The Goyder lagoon, located in the middle part of the river, near the city of Birdsville, was chosen as target to assess the potential of the method. This includes surface Reflectance measurements from the MODIS Terra instrument to detect water on the area of study and monitor the spread of aquatic vegetation on a daily basis. A Topography map of the Goyder Lagoon was obtained from the Laser altimetry data on the Icesat satellite. It has the capability to determine water level with high precision and high resolution along the satellite track, but on a flat, regular and dry surface, it can be also used to measure the vertical topography, which then can be derived as Pseudo Digital Elevation Model through two-dimensional interpolation. To compute water level variations on continental surface, such as lakes, rivers, or wetland, the radar altimetry is a useful tool with time resolution ranging from 10 to 35 days depending on the satellite. Based on these different techniques it is hence possible to determine extent of water within a given area, as well as its volume of water evolution, which is key parameter in the understanding of hydrological regime of big rivers, in particular in regions affected

by large flood event. To validate the method Global Positioning System data obtained during a field campaign, carried out in Summer 2006, has been used as a calibration mean for the Icesat-derived topography on few point of control on the Goyder Lagoon. A series of airborne GPS measurements has been also used to map horizontal areas covered by open water, aquatic vegetation, vegetation on dry land and then detect the limit zone between each type of terrain. It allowed estimating threshold values of the surface reflectance in different bands of frequency of the MODIS sensor that were used to characterise the land surface. The uses of concomitant altimetry measurements on the Envisat and Topex / Poseidon satellites gave estimation of volume variation in the Goyder Lagoon during the pass time of the flood. Finally, In-Situ runoff data obtained at the gauge station of Birdsville provided a control value for the computation of volume of water. This method which was successfully tested in the river basin of the Diamantina, is particularly suitable to all kind of Earth surface in arid zone characterized by small vegetation coverage, clear sky all quite all the time, and presence of non stationary water bodies such as flood plain or wetland.